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FILTER ELEMENT AND A FASTENING SYSTEM FOR A FILTER ELEMENT [FILTERELEMENT SAMT ET FASTGØRELSESSYTEM TIL ET FILTERELEMENT]

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A FILTER ELEMENT AND A FASTENING SYSTEM FOR A FILTER ELEMENT

The present invention relates to a filter element for use in connection with gas turbines, for example, comprised of a hollow internal cartridge, inside which, and centrally in relation to the external cartridge, a hollow internal cartridge is placed, said cartridges having terminal edges to which at one end a top flange is attached.

The invention also includes a fastening system for a filter element.

Known technology

From US Patent 4,720,292, an air filter is known that comprises a tube-shaped housing, consisting of an external wall, in which there is an external inlet. At one open end of the housing, a cover is placed, comprising a circular end wall with an axial outlet opening, as well as an outwardly extending tube section around the axial outlet opening. An outlet element is placed on the outlet opening, said element being formed in such a way that it can be placed on the outlet opening by a snap action, so that the outlet element is held in place.

At the other opening of the housing, a circular, outwardly extending flange is placed, to which a detachable cover is connected.

Coaxially to the housing, a tube-shaped filter element is placed, comprising an internal cartridge and an external cartridge, which, together with the external walls of the housing, comprise a distribution chamber for the incoming air. Between the eternal and the internal cartridge, a paper filter is placed.

The housing, including the inlet opening, is manufactured in the known way of a plastic material, and in order to resist axial compression without collapsing, both the internal cartridge and the external cartridge are constructed of a perforated metal, these cartridges thus providing the actual stiffening of the air filter.

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In order to close one open end of the filter element, and in so doing secure the ends to the internal and external cartridges, a circular layer of urethane foam material is applied, which has a relatively soft, rubbery consistency. This layer is connected to the detachable cover by overhangs made on the circular cover. In order to maintain the central placement of the filter element in the

housing, the diameter of the housing around the cover is essentially identical to the internal diameter of the cover.

At the other end, opposite to the cover of the housing, the filter element is provided with a ring-like end-cover made of an elastomer material, such as, for example, a urethane foam material, which is cast over the terminal ends of the external and internal cartridges respectively, as well as over the paper filter. The surface of the end-cover is compressed in order to achieve an airtight seal between the end-cover and the outlet element.

When the filter is in use, contaminated air is sucked in through the inlet opening into the distribution chamber, where the air is then evenly disturbed over the internal surface of the filter element and is sucked through the paper filter of the internal filter element for discharge through the outlet opening. All foreign particles carried by the incoming air will thus be trapped in the paper filter.

From US Patent 5,792,227, another filter arrangement is known for filtering materials composed of particles from gas flows, for example air flows, where the filter arrangement, besides being circular in terms of construction, can also take an oval form, and where modified materials are used in order to avoid leakage,

among other things, and in that way the disadvantage of a shorter lifetime.

Between the external and internal cartridges, are three areas, situated one after the other, a first area, a middle area, and a third area, where the latter is essentially identical with the paper filter cited in US 4,720,292.

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The first area, which is flush with the external cartridge of the housing, comprises a dust storage zone consisting of a woven material, the fibers of which range from 20-45 µm in size, for example, polyester fiber. The middle area is constructed so that only 6-7% of the total material can pass through it, and can, for example, be manufactured of several compound polyester types.

When this filter is used, it differs from the filter described in US 4,720,292 by being more efficient, being able to trap particles of varying size, which also results in the achievement of a longer lifetime for the filter.

This known filter is constructed primarily for use/placement in motor vehicles, where there is a need for universal filtering, and is therefore not constructed for use in connection with gas turbines.

In addition, only individual components of the filter as a whole are made of plastics/synthetic materials. An environmentally friendly way of disposing of the filter, for example by burning it, is therefore not possible without first taking the filter apart, which is a time-consuming and expensive business.

The new technology

The invention is based on the wish to devise a filter element where all components are made of materials that can be disposed of in an environmentally friendly way after use of the filter is finished.

A further intention is to devise a fastening system for the filter element.

The innovation in the case of the inventive filter element is that the top flange is manufactured of a polyurethane foam, and that the filter element is stiffened by at least one cartridge being manufactured of a basic material, to which a piece of netting is affixed by means of one or more hot-melt lines, said basic material and said netting being manufactured of a combustible material.

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By using combustible materials exclusively in manufacturing the filter element, the filter element can easily be

disposed of after use, it not being necessary to take the filter apart first.

The chosen materials result in a simplification of the construction of the filter element, because the materials adhering to each other results in optimum stiffening of the filter element.

Correspondingly, the composition of materials results in it not being necessary to have an extra layer of material between the two cartridges in order to ensure optimum entrapment of dust particles.

Due to the optimum stiffening of the filter element, the demands for a fastening system for this kind of filter element will be minimal, because additional stiffening is not necessary. In this way, the filter element itself constitutes a housing for the filter.

The invention will now be explained in more detail with reference to the drawing, which

Fig. 1 depicts an external cartridge and an internal cartridge of a filter element according to the invention, and

Fig. 2 shows a fastening system for the filter element shown in Fig. 1.

Embodiments

Figure 1 depicts a filter element 1 according to the invention, comprising a hollow external cartridge 2 inside which a hollow internal cartridge 3 is placed.

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In this embodiment, both the external cartridge 2 and the internal cartridge 3 are tube-shaped with congruent centerlines L.

The external cartridge 2 is constructed of a basic material comprising a filter material 4, which is made of a plastic/synthetic material, for example cellulose and polyester. External netting 5 is applied around the filter material 4, said netting being made of a plastic/synthetic material, for example HDPE, high-density polyethylene, or LDPE, low-density polyethylene. The external netting 5 is fastened to the filter material 4 by a spiral-formed, or otherwise formed hot-melt line 6, which in addition to holding the respective materials together, is also intended to stiffen the external cartridge 2 in a simple manner, whereby materials that are unsuitable for environmental reasons, for example adhesives and/or solder can be avoided.

The internal cartridge 3 is, in principle, constructed in the same way as the external cartridge 2, because both consist of a basic material (not shown on the drawing),

comprising a filter material, around which internal netting 7 is applied. The internal netting 7 is manufactured of a plastic/synthetic material, for example PP, polypropylene, or HDPE, high density polyethylene, and is, like the external netting 5, fastened to a filter material by a spiral-shaped hot-melt line 6, whereby the hot-melt line 6, in this context as well, functions as a stiffening means and can take another form, for example, a line that is circular in parts.

The plastics/synthetic materials that are used to construct the respective cartridges, the external cartridge 2 and the internal cartridge 3, should be seen only as a guideline/illustrative example, because other plastics/synthetic materials could easily be imagined as advantageous for use. In addition, the cartridges 2, 3 can be comprised of more or fewer layers of materials, which are comprised of a single or multiple composite materials, just as the cartridges 2, 3 can be comprised of identical or different types of materials, but where it is essential, regardless of the choice of materials or their combination, that all materials be made of some form of synthetic material, so that the materials can be disposed of by burning when the filter is no longer used.

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The external diameter of the internal cartridge 3 is less than the internal diameter of the external cartridge 2, so that when placing the internal cartridge into the external cartridge 2, this, along with a partial closure of the filter element 1, will also create a space 8 for collecting dust particles from the air that is sucked in.

For partial closure of the open ends of filter element 1, a flange is affixed to each end using a solder, said flanges being designated a top flange 9 and bottom flange 10. The solder will therefore be applied to the respective terminal edges of the external cartridge 2 and the internal cartridge 3, whereby the molten metal will also bring about a stabilization of the interior cartridge 3.

Each flange 9, 10 assumes a form that depends on the shape of the interior cartridge 3 and the external cartridge 2. In this embodiment, both the top flange 9 and the bottom flange 10 therefore take the shape of a ring with a radial thickness that corresponds to the difference between the external diameter of the external cartridge 2 and the internal diameter of the internal cartridge 3. The opening that this leaves (not shown on the drawing) will thereby function as the outlet opening of the filter element 1, where cleaned air exits.

In this embodiment, both flanges 9, 10 are made of a polyurethane foam, but they could conceivably be made of a different material, or of composite plastics/synthetic materials. Correspondingly, polyurethane foam is used as a soldering material, but here too, a different solder could conceivably be used. The essential aspect of the invention is that both the flanges 9, 10 and the solder consist of one or more plastics/synthetic materials.

In connection with the assembly of filter element 1, where it is important that the air that is taken in does not leak out of the filter element 1, a packing/gasket is used (not shown on the drawing), which also consists of a plastic/synthetic material, for example a polyurethane form.

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The external cartridge 2 and the internal cartridge 3 can in principle take any form at all, and could for example be conical. A conical shape would mean that one flange, the bottom flange 10, could be dispensed with, which would mean that a less expensive filter could be manufactured. With the largest cross section oriented toward the suction side, a conical shape would therefore mean that the cross section increases through the filter, whereby the air velocity drops.

Figure 2 shows a fastening system 12, to which the filter element 1 has been fastened. The fastening system 12 is made of a metallic or other hard material and comprises an upper fastening element 13 and a fastening element 14 that is in lower position relative to the upper fastening element 13, in which the connection between the two fastening components 13, 14 is established by a suspension means 17.

In this embodiment, the upper fastening component 13 is a flange, which on the side that is oriented toward the lower fastening component 14, has delimiting edges 19 that are located at a distance from each other that corresponds to the external width of the top flange 9 of the filter element, so that the edges 19 rest against and support the sides of the top flange 9. Placed between the delimiting edges 19, and oriented in the same direction, is V-shaped suspension component 18, which is a part of the suspension means 17. The suspension element 18 is fastened to the flange 13 by means of point welding, and opposite to the suspension element 18, a handle 22 is mounted for fixing the fastening system 12 in place.

The lower fastening component 14 is comprised of a plate with an opening 20, and on the side of the plate 14 that is oriented toward the upper fastening element 14, there are two delimiting edges 19 at the same distance to each other as the delimiting edges 19 on the upper fastening element 13. Correspondingly, the edges 19, in this way, rest against and support the sides of the bottom flange 10. Via the opening 20, a hooked rod 15 is introduced, with its hook element 11 inserted into the suspension element 18. The hooked rod 15 thus forms another element of the suspension means 17.

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The hooked rod 15, as the name implies, is comprised of a hook and a rod, in which the free end of the rod, that is the part opposite to the hook element 11, is comprised of a thread 16, and when the hooked element is inserted into the suspension element 18 (marked by stippling), the lower fastening element 14 is affixed to the upper fastening element 13 by screwing on a wing or butterfly nut 21.

The shape of the upper fastening element 13 and the lower fastening element 14, shall be seen more as an illustrative than as an exact form of an embodiment,

because this fastening element can easily be elaborated differently.

Correspondingly, the suspension means 17 can be made according to other models of solutions, for example by means of screw arrangements, or by a wall that abuts against the internal cartridge, and which thus provides additional reinforcement.

PATENT CLAIMS

1. A filter element (1) for use, for example, with gas turbines, comprising and external hollow cartridge (2), into which and centrally in relation to the external cartridge (2), a hollow internal cartridge (3) is placed, said cartridges (2, 3) having terminal edges, to which, on one end, a top flange (9) is fastened, characterized in that the top flange is made of polyurethane foam, and that the filter element (1) is stiffened in that at least one cartridge (2, 3), is constructed of a basic material (4), to which a piece netting (5, 7) is attached by one or more hot-melt lines (6), said basic material (4) and said netting (5, 7) being produced of a combustible material.

2. A filter element (1) according to Claim 1, characterized in that a bottom flange (10) is attached to the terminal edges of the other end of the cartridges (2, 3), said bottom flange (10) and said top flange (9), at their respective ends, extend between the terminal end of the external cartridge (2)

and the terminal edge of the internal cartridge (3), and are affixed to said cartridges by a solder consisting of polyurethane foam.

3. A filter element (1) according to Claim 1 or 2 characterized in that the external diameter of the internal cartridge (3) is less than the internal diameter of the external cartridge (2) in order to create a space (8) for collecting dust particles from the air that is sucked in.

4. A filter element (1) according to one of the previous claims, characterized in that a basic material (4) is comprised of a filter material, for example cellulose and polyester.

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5. A filter element (1) according to one of the previous claims, characterized in that the netting (5, 7) is produced of HDPE, for example, or of LDPE.

6. A fastening system (12) for a filter element (1) according to Claim 1-5, characterized in that the fastening system (12) is made of a metallic or other hard material comprising an upper fastening element

(13) and a fastening element (14) that in relative terms is lower than the upper fastening element (13), said lower fastening element being connected to the upper fastening element (13) by a means of suspension.

7. A fastening system (12) according to Claim 6, characterized in that, the upper fastening element (13) comprises a flange with delimited edges (19) for resting against the sides of the tope flange (9).

8. A fastening system (12) according to Claim 6, characterized in that the lower fastening element (14) comprises a plate with an opening (21), as well as delimiting edges (19) for resting against the side of the bottom flange (10).

9. A fastening system (12) according to Claims 6-7, characterized in that the means of suspension (17) comprises a V-shaped suspension element (18) and a hooked rod (15) for inserting into the suspension element (18), said suspension element (18) being placed between the delimiting edges (19) of the flange (199 on the upper fastening element (13), and which

hooked rod (15) is inserted into the opening (20) in the lower fastening element (14).

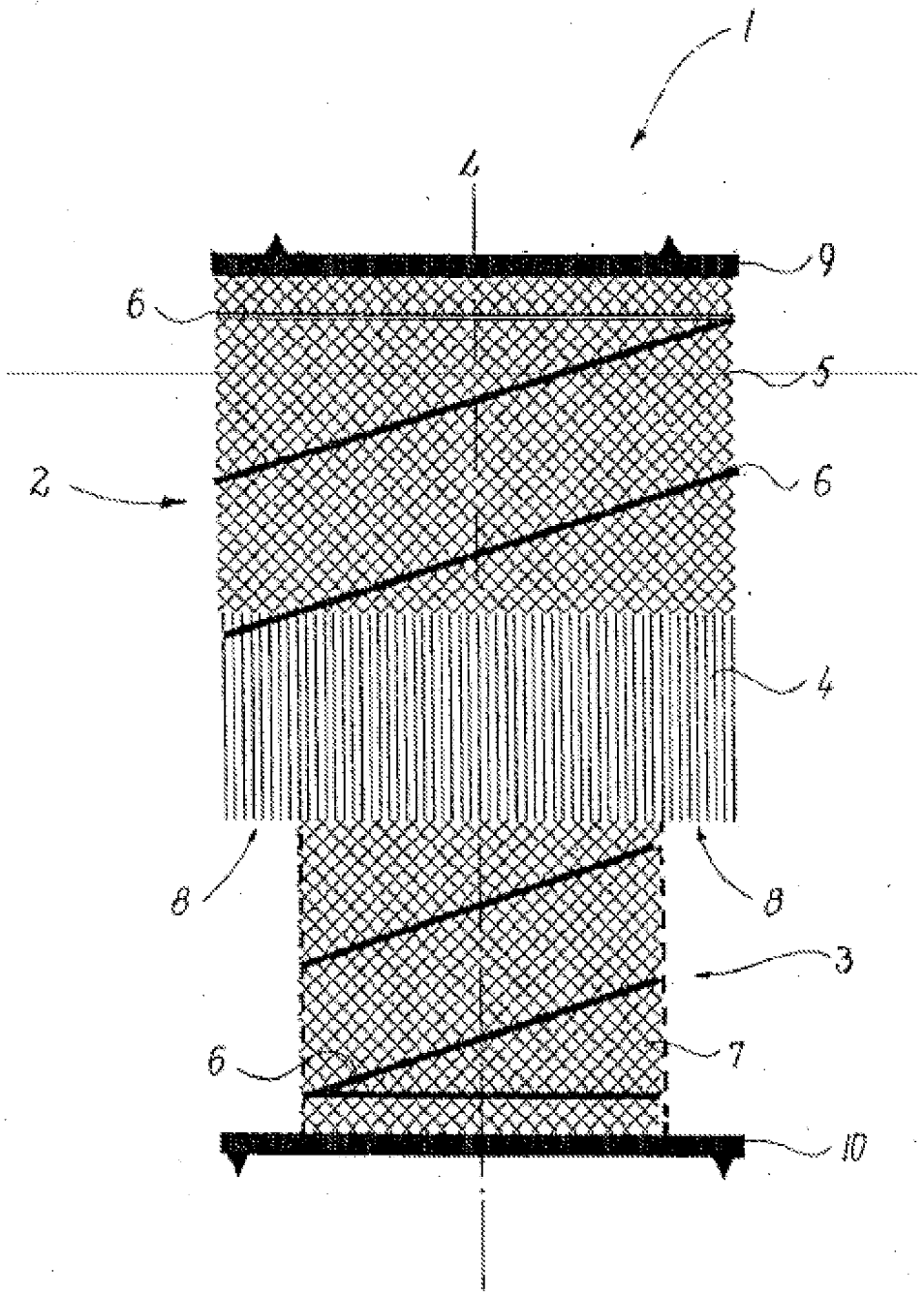

FIG.1

Figure 1

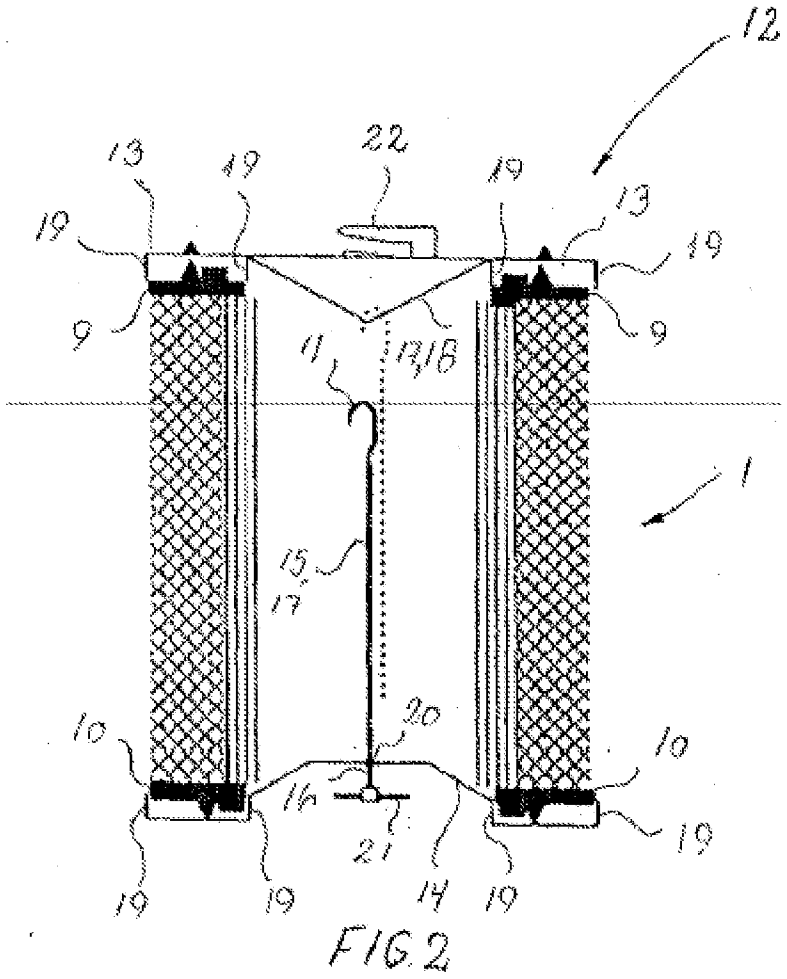

FIG. 2

Figure 2